King County

Department of Natural Resources and Parks

Wastewater Treatment Division

Contract P00208P16
Professional Services for Evaluation of Inflow and Infiltration Reduction Concepts

Phase 1: Evaluation of Concepts

Task 410
Verify 2004 King County Final Draft Regional I/I Control Standards, Procedures, and Policies

Final Technical Memorandum

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Project 150258

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Revision History

Date	Revision	Reason for Revision
Oct 2017	1	Incorporated review comments and finalized

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1.0 Background and Purpose

This introductory section presents the background and purpose for this Task 410 technical memorandum (TM).

Background

Inflow and infiltration (I/I) is rainwater, surface water, and groundwater that flows directly and indirectly into sanitary sewers. Although sewer design guidelines include a reasonable allowance for I/I, excessive rates of I/I in a sanitary sewer system can lead to basement backups, sanitary sewer overflows, and unnecessary treatment costs. Excessive I/I flows in King County's (KC's) regional separate sanitary sewer system impact both capital and operational costs.

KC Water Treatment Division's (WTD) Conveyance System Improvement (CSI) Program assesses the hydraulic capacity of the regional wastewater system with projected 20-year peak flows. This information is used to plan and size future capacity-related improvement projects.

Findings from CSI Program analysis show that about 70 percent of the peak flow in the separate sanitary sewer system is rain-derived inflow and infiltration. An estimated 27 percent of the annual wastewater system volume treated by KC's wastewater treatment plants can be attributed to I/I.

This I/I results in higher capital program costs by accelerating the need and scale of capacity improvement projects. Operational costs are increased because of the need to transport and treat higher rates of flow. The additional capital costs associated with increasing the capacity of the collection system, pump station, and wastewater treatment plant to handle excessive I/I flows are currently spread across all customers through WTD's sewer rates.

WTD implemented an I/I Control Program in 1999 as part of the Regional Wastewater Services Plan. Currently, the I/I Control Program efforts are focused on portions of the sanitary sewer system experiencing flow capacity shortages. Specifically, the I/I Control Program has developed data to assess where pursuing I/I reduction might be more cost-effective than increasing pipe and/or pump station capacity. Thus far, the I/I Control Program has been effective in reducing I/I experienced in some areas of the regional wastewater system; however, no comprehensive program is currently in place to address I/I throughout the regional wastewater system.

The Phase 1: Evaluation of Inflow and Infiltration (I/I) Reduction Concepts project has been developed to assist KC WTD in the exploration of new elements for the Regional I/I Control Program. This project will build on the work that WTD has done previously and explore more comprehensive and system-wide I/I reduction. WTD selected Brown and Caldwell (Consultant) per the P00208P16 Professional Services Contract to assist with this project. The Consultant has been tasked with the following in Phase 1:

- Collect and share existing I/I Control Program information with the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC)
- Review sewer and side sewer standards, assess existing local agency standards compared to best management practices (BMPs), and develop an approach to achieve common standards in the region
- Evaluate current city and utility district inspection programs for sewers and side sewers to identify BMPs and develop an outline for a regional inspection training program
- Identify the types of private side sewer programs in common use nationally, and evaluate private side sewer programs within the KC service areas for side sewer inspection and certification, grants or loans, and regional I/I support
- Develop a framework for implementing private side sewer programs within the KC service areas, specifically for side sewer inspection and certification, grants or loans, and regional I/I support

Purpose

The purpose of this Task 410 TM is to review KC's document: 2004 King County Final Draft Regional I/I Control Standards, Procedures, and Policies, hereafter referred to as the 2004 KC Standards. This review includes a comparison to relevant national standards and to key references such as the American Public Works Association standard specifications; U.S. Environmental Protection Agency (EPA) Capacity, Management, Operation, and Maintenance (CMOM) program; and applicable Water Environment Federation (WEF) Manuals of Practice.

The 2004 KC Standards can be found in Appendix B of the following document: http://www.kingcounty.gov/~/media/services/environment/wastewater/i-i/docs/Reports/0512_II_Control_Program_Recommendations.ashx?la=en

During the review, it was noted that KC has not updated its standards since 2004. National I/I reduction BMPs have evolved since 2004 and, because of the advancement of condition assessment equipment and computer technology, different sets of tools, methods, and accepted approaches are not in the 2004 KC Standards. For the purposes of this review, the evaluation was kept at a high level because of these advancements and the difficulty to effectively evaluate the appropriateness and applicability of these refined BMPs in context with the 2004 KC Standards.

2.0 Review of 2004 KC Standards, Procedures, and Policies

This section presents a review of the 2004 KC standards, procedures, and policies for I/I.

I/I Standards and Procedures

The 2004 KC Standards were kept in final draft form and presented as recommended (voluntary, not mandatory) standards for local agencies. Some elements appeared to have been written purposely vaguely so that they could be interpreted as appropriate on a local level. And as I/I BMP technologies and methods have improved in the past 13 years and been adopted on local and/or national levels, related elements of the 2004 KC Standards were not necessarily updated.

Standard guidelines that appear to be consistent with BMPs implemented by utilities that have sustained, successful I/I reduction programs include the following:

- PS-1: Storm Drainage Connections to the Sanitary Sewer
- PUB-4: Manhole Size
- PUB-6: Side Sewer Connection Location and Taps
- PUB-7: Sewer System Design
- PUB-19: Product Specific Inspection
- PRV-1: Pipe Protection—Depth of Cover
- PRV-2: Allowable Connections to Side Sewers
- PRV-3: Pipe Zone Bedding and Trench Backfill

Other guidelines, if updated to include current best available technologies, could be more consistent with national I/I reduction BMPs. Examples of these guidelines include:

- PS-4: Closed Circuit Television (CCTV) Inspection of Sewer for Sanitary Sewer Evaluation Survey (SSES) Investigations
- PS-6: Dye Testing (add practice of simultaneously televising the sanitary sewer and laterals during the test)
- PUB-9: Pipe Rehabilitation Methods
- PUB-10: Spot Repairs
- PUB-15: Pipeline Leak Testing
- PUB-16: Manhole Leak Testing
- PRV-6: Lateral and Side Sewer Rehabilitation Methods

- PRV-7: Spot Repairs
- PRV-9: Side Sewer/Lateral Leak Testing
- PRV-10: Sanitary Side Sewer CCTV Requirements

Reviewers noted that provisions of a few I/I reduction guidelines may not be in accordance with current Occupational Health and Safety Administration (OSHA) regulations or Washington Department of Ecology or Washington Department of Fish and Wildlife acceptable practices. An example of a questionable guideline, when applied to specific regions of KC's service area, is found in PS-6: Dye Testing for SSES Investigations (plugging or damming stream sections for SSES investigations).

Other BMPs implemented by utilities with successful I/I reduction programs that are not included in the 2004 KC Standards include the following:

- Installing trench dams to reduce the potential for groundwater to migrate to other unrehabilitated sewer segments
- Implementing the practice of locating and mapping side sewers
- Developing a program for coordinating with other utilities to reduce the risk of cross-bore conflicts with side sewers
- Polyvinyl chloride (PVC) pipe connections into manholes (requiring the first joint to be at least 10 feet from structure)
- Adopting operational BMPs such as conducting unimproved alignment (easement) walks to visually identify vulnerable manholes and other structures
- Requiring downspout disconnection, sump pump redirection, and other private I/I source actions when deemed appropriate

Many of these BMPs are currently used by local agencies within the KC service area.

Additionally, some I/I prevention and reduction measures undertaken by local agencies may be considered "local BMPs," as circumstances encountered in the Pacific Northwest are different from those encountered in other parts of the United States. These local BMPs are further discussed in the Task 420 TM: Assessment of Existing Local Agency Sewer and Side Sewer Standards, and include, but are not limited to, the following:

- Lake line guidance (City of Mercer Island)
- Side sewer disconnection and reconnection standards and details (City of Pacific)
- Side sewer installation under rockeries/retaining walls (Coal Creek Utility District)
- Side sewer installation in steep slopes (Valley View Sewer District)
- Locking manhole covers for manholes located in easement or off-road surfaces (Lakehaven Water and Sewer District)

I/I Policies

As with the I/I standards and procedures, the 2004 I/I policies were also kept in final draft form and presented as recommended to the local agencies. More is now known about available funding and contracting mechanisms, local and regional stormwater policies, and KC's overall approach to developing project-specific I/I-related specifications, it was found that some of the 2004 I/I policies were outdated. However, many of the policies are still sound and should be supported.

A summary of the 2004 KC I/I policies review findings is provided in Table 1 below.

Table 1. 2004 KC I/I Policies Review Summary		
Policy #	Issue	Comment
1	Public funding for I/I reduction projects	There is no indication that KC intends to fund all phases of I/I mitigation work on privately owned property, and it may not be in the best interest of KC or local agencies to set such a precedent now.
2	Public awareness of I/I: educational materials	Information maintained on KC's website is useful but somewhat dated (http://www.kingcounty.gov/services/environment/wastewater/ii/resources.aspx). KC could provide examples of current local agency-generated educational materials and/or a link to WEF's Private Property Virtual Library (http://www.wefppvl.org/WEF-PPVL-library/).
3	Public awareness of I/I: responsibility for community	This policy appears to be supported by many local agencies, and is a strong policy to help prevent and/or mitigate the impact of I/I.
4	Access to private property for I/I reduction and control	This is a strong policy that should be supported; KC could consider providing example legal authority language to local agencies.
5	Inspection training	Programmatic support for this policy is being developed as part of this project.
6	Limiting liability	This is a strong policy that should be supported; KC could consider providing example contract language to local agencies.
7	Bonding, licensing, insurance, and warranty provisions	This is a strong policy that should be supported; KC could consider providing example contract language to local agencies.
8	Stormwater drainage ordinances	This is a strong policy that should be supported.
9	Responsibility for stormwater drainage	This is a strong policy that should be supported.
10	Infeasible and/or prohibitively expensive modifications	This is a strong policy that should be supported.
11	Property restoration	This is a strong policy that should be supported.
12	Contractor qualifications	This policy may be overwhelming for local agencies that may have only one-off projects that address I/I; however, establishing a regional prequalification program may make sense and attract reputable sewer rehabilitation contractors to bid on projects in the KC service area.
13	Required permits	This is a strong policy that should be supported; KC could consider developing a permitting checklist that could be used by local agencies.
14	Cooperative efforts	Strong policy that should be supported.
15	Revisions to standards, procedures, and policies	As fully developed I/I-related specifications and procedures were not developed following adoption of the 2004 KC Standards, this policy may not be appropriate now.

3.0 Summary

The purpose of this TM is to compare the 2004 KC Standards to national I/I reduction BMPs. During the review, it was noted that KC has not updated its standards since 2004. National I/I reduction BMPs have evolved since 2004 and, because of the advancement of condition assessment equipment and computer technology, different sets of tools, methods, and accepted approaches are not in the 2004 KC Standards. For the purposes of this review, the evaluation was kept at a high level because of these advancements and the difficulty to effectively evaluate the appropriateness and applicability of these refined BMPs in context with the 2004 KC Standards.

The evaluation found that some of the 2004 KC Standards are still relevant as written; however, other standards are purposely vague, outdated, and/or lacking in enough detail to be considered suitable guidance. If KC wants to implement a program at a regional level, an updated set of standards, practices, and policies would need to be developed to reflect national and local BMPs.

Many of the local agencies have continued to evolve their standards, practices, and policies since 2004 and have adopted practices that are in alignment with national BMPs. This is discussed in the Task 420 TM: Assessment of Existing Local Agency Sewer and Side Sewer Standards.